Revista de Gestão Ambiental e Sustentabilidade – GeAS

Received: 09 Aug. 2017 / **Aproved:** 10 May 2019
Evaluation Process: *Double Blind Review*
DOI: https://doi.org/10.5585/geas.v8i2.1018
e-ISSN: 2316-9834

Assessment of operations sustainability in federal institutions of higher education using Stars: the experience of the Federal University of Santa Catarina

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ABSTRACT

Objective of the study: Assess the sustainability of the operations of the Federal University of Santa Catarina's campuses using STARS.

Methodology / Approach: STARS (Sustainability Tracking, Assessment and Rating System) was used since it has been widely employed for the assessment of the sustainability of organizational processes by universities and in scientific research.

Originality / Relevance: Since the 1970s, the United Nations has recognized the role of higher education in promoting sustainability. Universities have aimed to promote it in all their dimensions i.e. education, research, planning and operations (i.e., energy and water consumption, greenhouse gas emissions, solid waste generation, food purchase, transport among others).
Main results: The results indicate that at the time of the study the Institution did not have stable and structured sustainability practices, and the role of the federal government in this context was relevant.

Theoretical / methodological contributions: This was the first study to use STARS in a Brazilian university. It presents new data for the discussion on sustainability in universities, besides highlighting the role of the federal government as a promoter of public policies in this area.
Conclusion: The Institution needs to be structured to advance in terms of operational sustainability, and the federal government can be a great motivator in this regard.

Keywords: Sustainability in Universities. Sustainability Assessment in Universities. Environmental Management. Sustainability in Public Services.

Cite as:
Pacheco, R. M., Machado, M. de M., Montalván, R. A. V., & Pinto, C. R. S. de C. (2019). Assessment of operations sustainability in federal institutions of higher education using Stars: the experience of the Federal University of Santa Catarina. *Rev. Gest. Ambient. Sustentabilidade - GeAS*, *8*(2), 205-234. https://doi.org/10.5585/geas.v8i2.1018

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Análise da sustentabilidade das operações de instituições federais de ensino superior com a ferramenta Stars: a experiência da Universidade Federal de Santa Catarina

RESUMO

Objetivo do estudo: Aplicar a ferramenta STARS na análise da sustentabilidade das operações dos *campi* da Universidade Federal de Santa Catarina.

Metodologia/Abordagem: Utilizou-se o STARS (*Sustainability Tracking, Assessment and Rating System*), que tem sido amplamente empregado por universidades e em pesquisas científicas para a análise da sustentabilidade de processos organizacionais.

Originalidade/Relevância: Desde a década de 1970 a Organização da Nações Unidas reconhece o papel do ensino superior na promoção da sustentabilidade. Universidades têm visado promovê-la em todas as suas dimensões, seja no ensino, pesquisa, planejamento e operações (i.e., consumo de energia e água, emissão de gases de efeito estufa, geração de resíduos sólidos, compra de alimentos, transporte entre outros).

Principais resultados: Os resultados demonstraram que no momento do estudo a Instituição não contava com práticas de sustentabilidade estáveis e estruturadas, sendo relevante o papel do governo federal nesse contexto.
Contribuições teóricas/metodológicas: O presente estudo foi o primeiro a usar o STARS em uma universidade brasileira. O estudo trouxe novos dados para a discussão sobre a sustentabilidade em universidades, além de destacar o papel do governo federal enquanto promotor de políticas públicas nesta área.

Conclusão: A Instituição precisa se estruturar para avançar em termos de sustentabilidade operacional, sendo que o governo federal pode ser um grande impulsionador nesse sentido.

Palavras-chave: Sustentabilidade em universidades. Análise da Sustentabilidade em Universidades. Gestão Ambiental. Sustentabilidade no Serviço Público.

Análisis de la sostenibilidad de las operaciones de instituciones federales de educación superior con la herramienta Stars: la experiencia de la Universidad Federal de Santa Catarina

RESUMEN

Objetivo del estudio: Aplicar la herramienta STARS en el análisis de la sostenibilidad de las operaciones de los campus de la Universidad Federal de Santa Catarina.

Metodología / enfoque: Se utilizó el STARS, que ha sido ampliamente empleado por universidades y en investigaciones científicas para el análisis de la sostenibilidad de procesos organizacionales.

Originalidad / Relevancia: La Organización de las Naciones Unidas reconoce el papel de las universidades en la promoción de la sostenibilidad. Las instituciones tienen el objetivo de promoverla en todas sus dimensiones, incluyendo las operaciones (i.e., consumo de energía y agua, emisión de gases de efecto invernadero, generación de residuos sólidos, compra de alimentos, transporte entre otros).

Principales resultados: Los resultados demostraron que la Institución no contaba con prácticas de sustentabilidad estables ni estructuradas, siendo relevante el papel del gobierno federal en ese contexto.

Contribuciones teóricas / metodológicas: Este fue el primer estudio el STARS en una universidad brasileña. Se obtuvieron nuevos datos para la discusión sobre la sostenibilidad en universidades, además de destacar el papel del gobierno federal como promotor de políticas públicas.

Conclusión: La Institución necesita estructurarse para avanzar en términos de sostenibilidad operacional, siendo que el gobierno federal puede ser un gran impulsor en ese sentido.

Palabras clave: Sostenibilidad en las universidades. Análisis de la Sostenibilidad en Universidades. Gestión ambiental. Sostenibilidad en el Servicio Público.

Introduction

Concerns about the relationship between the environment and humanity did not begin at a specific point in time or space. According to McCormick (1991), there was no specific event that triggered a large-scale environmental movement, but some emerging factors were important, such as the progress in scientific research, increased personal mobility, industrial intensification, population growth, and changes in economic and social relations.

The 1960s, characterized by several cultural and social revolutions, provided the right scenario for the merging of the growing environmental concerns (Rome, 2003). However, it was only in the 1970s that there was the first major global event on the subject, the United Nations Conference on the Human Environment (also known as the Stockholm Conference).

Since then, numerous international events have been held on this theme and sustainable development has become a central topic on many official agendas, especially on the UN agenda. The need to involve the universities in this process was noticed from the beginning of the movement. In 1972, the United Nations Conference on the Human Environment Report made the first reference to sustainability in higher education (UN, 1972).

Since then, more than 24 international initiatives focused on sustainability education have been officially constituted, 14 of which are directed specifically at promoting sustainability in higher education (Lozano, Lukman, Lozano, Huisingh, & Lambrechts, 2013). According to Amaral, Martins and Gouveia (2015), higher education institutions (HEIs) play a central role in the quest for sustainable development. They have a special responsibility in the

development of society, particularly in educating future leaders and in spreading awareness of sustainability. Therefore, universities must "lead by example".

According to Lozano et al. (2014), since the 1970s, higher education institutions have been engaged in efforts to better incorporate environmental aspects and sustainable development into their systems. They seek to cover aspects such as: institutional framework, education, research, outreach and collaboration, experience on-campus, assessment and reporting, as well as campus operations, which concerns the activities involving energy and water consumption, greenhouse gases emissions, solid waste generation, food purchases, transportation, among others.

In addition, in the operational dimension, large campuses resemble small cities in terms of population and urban characteristics (Saadatian, Sopian, & Salleh, 2013), which can generate serious direct and indirect environmental impacts (Alshuwaikhat & Abubakar, 2008). Considering this, several HEIs have made an effort to promote more sustainable operations on their campuses (Ruzman, Abdullah, & Wahid, 2014).

In the Brazilian context, the Federal Higher Education Institutions (FHEIs), in particular universities, have a central role in the country's development, since they are opinion-forming and knowledge-generating institutions (Mizael, Vilas Boas, Pereira, & Santos, 2013). There are currently 107 FHEIs in the country, of which 63 are universities (e-MEC, 2016), that are divided into 321 campuses, located in 275 municipalities (MEC, 2012).

As for sustainable development, because they are public institutions, FHEIs must comply with federal regulations and programs that promote organizational sustainability. Among them, three can be highlighted: The Environmental Agenda in Public Administration (from 1999), the Sustainable Esplanade Project (from 2012) and the Sustainable Logistics Management Plans (from 2012).

Considering this, it is evident that the FHEIs, among which is the Federal University of Santa Catarina, have two main reasons to seek more sustainable operations on their campuses. As discussed above, there is an international awareness of the importance of higher education in the dissemination of sustainable development and, because they are part of the federal government, FHEIs should follow their programs in favor of organizational sustainability. The Federal University of Santa Catarina – UFSC (Portuguese acronym), besides being a respected FHEIs, with several courses and projects dealing with sustainability, adhered to the main governmental programs in favor of organizational sustainability.

In this context, there is a need to find means to monitor and assess the effectiveness of institutional actions in favor of sustainability. To this end, several tools have been developed for the assessment of sustainability in HEIs (Shriberg, 2002; Cole, 2003; Lozano, 2006; Gómez, Sáez-Navarrete, Lioi, & Marzuca, 2015). Among the tools, there is STARS (Sustainability Tracking, Assessment and Rating System), which allows the measurement of sustainability in all dimensions of HEIs and provides data for comparison of results with that of other institutions (Shi & Lai, 2013).

In addition, STARS has been used in a variety of scientific researches (Murphy, 2009; Sayed MD, Kamal & Asmuss, 2013; Shi & Lai, 2013; Esteves, 2014; Lidstone, Wright, & Sherren, 2015; Urbanski & Leal Filho, 2015; Pacheco, 2016) and has been consolidating itself as an important tool for the assessment of sustainability in HEIs (Urbanski & Leal Filho, 2015).

Considering this context, the present study aimed to answer the following research questions: What is the level of sustainability of the Federal University of Santa Catarina campuses' operations according to the STARS rating? What led the Institution to obtain this score?

The purpose of these questions is to help diagnose the sustainability of the Institution's operations following common and consolidated metrics, both by academia and by organizations that seek to promote best practices in HEIs. Following this procedure, it is possible to understand how the level of sustainability of UFSC's operations compares to what would be the ideal level established by STARS. In addition, the process of using the tool helps to highlight the causes that lead to the final result. In this way, good practices can be valued and improved, solutions can be proposed for the identified limitations, as well as recognizing the agents that most influence the final result.

The present article is structured as follows: Introduction; Theoretical Reference, in which the theoretical bases that support this work are presented; Methodological Procedures, which characterize the research, in addition to briefly explain how STARS works and the data collection process; Results and Discussion, which presents the results of the application of STARS in UFSC, what was learned from this process, the role of the federal government as a promoter of organizational sustainability and a vision for the future, which answers the research questions; and, finally, the Final Considerations are presented, as well as the References.

Theoretical reference

2.1. Sustainability and Higher Education

From the beginning, higher education institutions followed the international concerns regarding the development of the planet. The first explicit reference to sustainability in higher education was made in 1972, in the United Nations Conference on the Human Environment Report (UN, 1972, p.12).

According to Amaral, Martins and Gouveia (2015), universities play a key role in the quest for sustainable development and must "lead by example" by promoting a pattern of development consistent with environmental protection and the principle of intra and inter-generational equity, in which the concept of sustainable development is based. Universities are unique types of organizations, since they need to go beyond the three dimensions of sustainability (economic, social and environmental), also including the dimensions of their organizational activities (education, research, operations, community outreach and reports).

In this sense, several HEIs have sought to incorporate environmental education and sustainability actions into their elementary systems, such as education, research, campus operations, community outreach, self-assessment and reporting (Lozano, et al., 2014). To that end, HEIs have developed a series of declarations, letters and initiatives to demonstrate their commitment to sustainability and to better incorporate it into their systems (Lozano, Lukman, Lozano, Huisingh, & Lambrechts, 2013).

According to Wright (2002), in general, the commitments made in these documents are centered on: sustainable physical operations; sustainable academic research; environmental literacy; ethical and moral responsibility; cooperation between universities and countries; interdisciplinary curriculum developments; partnerships with government, NGOs and industry; and outreach and public awareness.

In the study conducted by Lozano et al. (2014), which analyzed sustainability in 70 HEIs around the world, it was evident that there is a strong correlation between the commitment to sustainability, its implementation and the signing of declarations, letters and partnerships with this focus. That is, making the intention of including sustainability in the systems of an HEI official tends to bring practical results.

Still according to Lozano et al. (2014), there are seven main axes in which HEIs tend to act to promote sustainability. Table 1 shows these axes, with a brief description.

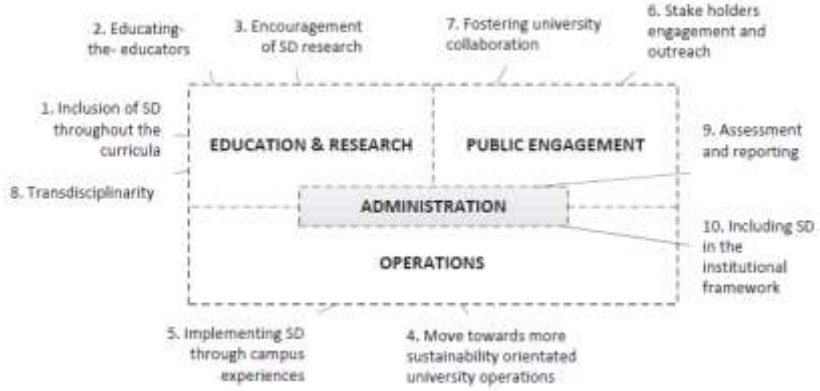
Table 1 - Sustainability axes in HEIs context.

Axis	Description
Institutional framework	policies, vision, mission, sustainable development (SD) office, and declarations signed.
Education	courses on SD, programs on SD, transdisciplinarity, curricular reviews, and 'Educate-the-educators' programs.
Research	research centers, research funding, holistic thinking, international recognition, SD research used in teaching, publications, patents, new knowledge and technologies, collaboration, and transdisciplinarity.
Outreach and collaboration	exchange programs for students in the field of SD, joint degrees with other universities, joint research, SD partnerships (e.g. enterprises, non-governmental organizations, and governments), being part of a UN Regional Centre of Expertise, and SD events open to the community.
Assessment and reporting	SD assessment, SD communication, environmental reports, sustainability reports, national environmental or sustainability HEIs rankings, and international environmental or sustainability HEIs rankings.
SD through on-campus experiences	SD working group, SD policies for students and staff, sustainable practices for students, SD visibility throughout the campus, SD awareness raising in the campus, and student and staff engagement.
Campus operations	energy use and energy efficiency, greenhouse gases, waste, water and water management, food purchasing, transport, accessibility for disabled people, and equality and diversity.

Source: Adapted from Lozano et al. (2014).

Based on sustainability statements and specific literature, Gómez, Sáez-Navarrete, Lioi, & Marzuca (2015) have created a conceptual model of the sustainability structure for an HEI, as shown in Figure 1. These dimensions are inter-connected (Lozano, 2006) and, in order to be successful, require an integration of the HEI systems' functions.

Figure 1 – Sustainability elements linked to the dimensions of the HEIs systems.



Source: Gómez, Sáez-Navarrete, Lioi, & Marzuca (2015).

At the base of the model are the "Campus Operations". At the top level are the main means of interaction with society, which would be "Education and Research" and "Public Engagement". Finally, at the center of the model is "Administration", which addresses all high-

level policies, strategies and decisions that influence the other dimensions (Gómez, Sáez-Navarrete, Lioi, & Marzuca, 2015).

Finally, Amaral, Martins and Gouveia (2015) point out that the lack of connection between the implementation and the management and assessment method may be one of the reasons why the management of sustainability in universities is not yet a stable and complete practice.

2.2 Brazilian Federal Institutions of Higher Education

The Brazilian university is a young institution, even in the Latin American context (TCU, 2008), and it has recently experienced an unprecedented expansion and restructuring (Duarte & de Oliveira, 2012).

In this context, federal higher education institutions (FHEIs), especially universities, play a prominent role in the country's development, as they are opinion-forming and knowledge-generating institutions (Mizael, Vilas Boas, Pereira, & Santos, 2013). Thus, the main challenge of the FHEIs is to build a dynamic balance between its expansion, with academic-scientific quality, and social commitment (TCU, 2008).

In administrative terms, federal public universities are part of the indirect administration, being created in the form of public autarchies or foundations. Their acts, in addition to undergoing supervision by the Federal Audit Court, are subject to internal control exercised by the Ministry of Education (STF, 2016).

Currently, Brazil has 107 FHEIs, of which 63 are universities (e-MEC, 2016), divided into 321 campuses and serving 275 municipalities (MEC, 2012). Table 2 shows the evolution of the numbers of federal universities in Brazil.

Table 2 – Expansion of Brazilian federal universities.

	2003	**2010**	**2014**
Universities	45	59 (14 new)	63 (4 new)
Campuses/Units	148	274 (126 new)	321 (47 new)
Municipalities Covered	114	230	275

Source: Adapted from MEC (2012).

Analyzing the number of universities and campuses in Brazil, their environmental impact potential is evident, even if they are fundamental in helping to transform society by researching and disseminating models of sustainable development.

In addition, as FHEIs are autarchies or foundations, subordinated to the federal government, it is important to mention the main federal governmental programs that address the sustainability theme.

2.3 Sustainability in Brazilian Public Administration

As a concept and a tool, sustainability is still at an early stage of development, and there is no consensus on which aspects of systems and organizations this theme is most relevant (Merad, Dechy, & Marcel, 2014).

Governments, thus, play a key role in its promotion by setting specific standards and legislation to conserve resources and the quality of life in an economic environment in which such actions can be understood as cost-increasing and detrimental to competitiveness (Wilkinson, Hill, & Gollan, 2001).

Batista (2012) points out that the objective of public organizations is to generate value for society, ensuring a sustainable development, without losing sight of the obligation of efficiently using resources. Considering that governmental purchases in Brazil move from 10 to 15% of the gross national product (MMA, 2009), and since there are more than 1 million public servants, only at the federal level (ENAP, 2015), it is evident that, by adopting internal sustainability actions, the government can generate a large-scale and positive impact on the country's development.

Therefore, in Brazil, laws, resolutions and programs have been developed in order to support sustainability measures. Among the governmental programs focused on sustainability in the public sector, in which FHEIs are included, three should be highlighted: The Environmental Agenda in Public Administration (A3P, Portuguese acronym), the Sustainable Esplanade Project (PES, Portuguese acronym), and the Sustainable Logistics Management Plan (PLS, Portuguese acronym).

These programs are under the responsibility of different ministries and vary in the way they are implemented. Yet, in general, all programs aim at raising awareness and training the

employees, promoting the rational use of resources, stimulating sustainable purchases, contracting and construction, as well as adequate waste management.

As A3P is the oldest program, created in the year 1999, and the reference for the others, it deserves special attention. It is a program, under the coordination of the Ministry of the Environment, and its purpose is to promote socio-environmental responsibility in public administration.

A3P is divided into six thematic axes: Rational use of natural resources and public goods; Adequate management of waste generated; Improvement of the quality of life in the work environment; Awareness and qualification of the employees; Contracting of sustainable goods and services; and Implementation of criteria for sustainable buildings. Through these axes, it aims to incorporate sustainability practices in a broad spectrum of activities in public administration.

2.4 Tools for the Assessment of Sustainability in Universities

The famous adage "What gets measured, gets done" is beginning to be applied to sustainability efforts in higher education (Shriberg, 2002). According to Amaral, Martins and Gouveia (2015), implementing sustainability through a set of operational and / or managerial measures is different from assessing and producing reports of institutional improvements in favor of a more sustainable environment.

Given the importance and complexity of the theme, several tools for assessing sustainability in universities began to be developed (Shriberg, 2002; Cole, 2003; Lozano, 2006; Gómez, Sáez-Navarrete, Lioi, & Marzuca, 2015). However, considering the specificities and variations of each tool, it is sometimes difficult to determine what would be the most appropriate instrument to be applied in a campus.

According to Gómez, Sáez-Navarrete, Lioi and Marzuca (2015), these tools present interesting approaches that integrate sustainability assessment in higher education institutions with other methods of assessment and reporting. However, the authors argue that despite the growing number of institutions employing these tools around the world, measuring sustainability remains a challenging process for universities at an early stage of implementing sustainability actions, as is the case in South America.

In this sense, de Castro and Jabbour (2013) affirm that there are few reports of sustainability assessment tools use in universities of emerging countries, such as the BRICS (Brazil, Russia, India, China and South Africa). According to Gómez, Sáez-Navarrete, Lioi, & Marzuca (2015), these institutions lack the means to complete most of these assessments, which impairs the understanding of their reality and makes comparing themselves with other institutions difficult.

Despite the wide variety of tools available, the Sustainability Tracking, Assessment and Rating System (STARS) was chosen to assess the sustainability of UFSC's operations. Although this tool is better suited to the reality of developed countries (de Castro & Jabbour, 2013; Gómez, Sáez-Navarrete, Lioi, & Marzuca, 2015), Gómez, Sáez-Navarrete, Lioi, & Marzuca (2015) acknowledge that STARS can be useful to support the sustainability journey of HEIs, serving as a guide, in which the experiences of more advanced institutions are presented through indicators, rationality and clear criteria.

Thus, considering that no assessment of the sustainability of UFSC's operations has been done previously, it is interesting to obtain a result that may, when appropriate, be compared with that of other institutions. Therefore, because there is no national database on the subject, STARS is an interesting alternative, since it provides data from more than 270 reports of different universities. In this sense, as stated by Urbanski and Leal Filho (2015), STARS is an important source of data on sustainability, which helps to highlight sustainability trends and best practices on campuses around the world.

Finally, it should be noted that there is a considerable and growing number of scientific studies that take STARS as the basis, and that these studies vary widely in scope and the great majority was conducted outside of Brazil. In fact, until the writing of this article, only one national study that used STARS was known. Table 3 summarizes the main studies that used STARS, as well as presents a brief description of their focus and main contributions.

Table 3 – Description and main contributions of the studies that used STARS.

Study	Description of the Study and Main Contributions
Murphy (2009)	• Dissertation addressing the involvement of Evergreen State College (ESC) in a pilot project to assess STARS deployment and its potential to inform the sustainability dialogue. • The research project was a case study with a multidisciplinary approach, for the data collection for the implementation of STARS. • The study showed that STARS was an effective tool to assess sustainability in ESC, led to organizational learning, and highlighted the Institution's dynamic and complex commitment to sustainability.

	• In addition, it pointed out that STARS could be further explored for its ability to help higher education institutions to fully embrace sustainability.
Sayed MD Kamal & Asmuss (2013)	• An article about a study conducted at the University of Saskatchewan - US (Canada), which sought an effective sustainability benchmarking tool to improve the performance in five critical "campus life" areas previously identified by the Institution: education, research, operations, governance, and community engagement. • In order to identify the appropriate benchmarking tool, four options were studied: the Sustainability Assessment Questionnaire (SAQ), the Campus Sustainability Assessment Framework (CSAF), the College of Sustainability Report Card (CSRC) and the Sustainability Tracking Assessment and Rating System (STARS). Each tool was evaluated based on 27 sustainability criteria on the five "campus life" areas. The higher the score, the better the result. • STARS scored highest in all "campus life" areas and was thus identified as the most effective tool for assessing and tracking sustainability in the US. • Extrapolating the results of the US evaluation, STARS seems to be the most effective sustainability benchmarking tool for assessing and monitoring sustainability in HEIs, and across the full extent of university life.
Lidstone, Wright, & Sherren (2015)	• This article reviews the sustainability plans of 21 Canadian HEIs that have used STARS. • It was identified that the objectives focused on the environmental aspects of sustainability were more emphasized than the social and economic aspects. • It was found that most of the plans were created through a broad stakeholder consultation process. However, few plans have set timetables and are the responsible actors for reaching the targets. • This study illustrated the priorities of Canadian HEIs at the end of the "Decade of Education for Sustainable Development" and it is useful for other HEIs interested in developing their own sustainability plans.
Urbanski & Leal Filho (2015)	• This article presents five main findings identified through the analysis of data that several HEIs submitted to STARS: 1) The interpretation of "sustainability" differs among the various higher education stakeholders; 2) There is growing interest in STARS within the international community; 3) Participation in STARS is greater among institutions that have doctoral and master's degrees programs; 4) The "basic type" institutions (undergraduate, graduate and postgraduate studies, etc.) tend to have an inferior sustainability performance; and 5) All STARS Institutions need to make progress in areas related to climate change. • Among the institutions analyzed, the article highlights the good performance of the following: Babson College, Chapman University, Cornell University, Haywood Community College and University of Monterrey. • The results of this article tell the story of a campus sustainability movement that is quite young. As STARS matures along with this movement, its data are expected to show a trend of continuous improvement in the participating institutions.
Pacheco (2016)	• This dissertation, conducted under the Graduate Program in Environmental Engineering at UFSC, had the general objective of analyzing the sustainability of UFSC's campuses operations with STARS. • The results of the tool showed that UFSC's operations had historical management problems. • When comparing the results obtained by UFSC with a university in the USA and another in Mexico that used STARS, it was observed that the Institution does not yet have sustainable operations, but is structuring itself in this sense, following the pattern observed in the other institutions. • Finally, the study suggested, based on previous results and on bibliographical and documentary review, possible actions to be taken by the federal government and UFSC to achieve more sustainable operations.

Source: Created by the authors.

The present study is based in part on the results of Pacheco (2016), which, until the writing of this article, was the only work that was known to use STARS in the Brazilian context.

2.5 Sustainability Tracking, Assessment and Rating System –STARS

According to AASHE (2015), STARS is a transparent self-reporting framework for colleges and universities that enables them to measure their performance in terms of sustainability. The System seeks to cover the entire spectrum of colleges and universities, from small colleges to large universities, in addition to those that have just begun to develop sustainability programs and those that already have a tradition in the subject.

The sustainability assessment promoted by STARS is structured around "credits", that is, aspects to be assessed, which address the breadth of sustainability in higher education and include performance indicators in four categories: Academics, Engagement, Operations and Planning and Administration. Table 4 shows the list of credits assessed by the tool in the category "Operations", which is the focus of this study.

Table 4 – Credits assessed in STARS 2.0 "Operations" category

STARS 2.0 Credit Checklist			
Subcategory	**Credit Number and Title**		**Points**
Air & Climate	OP 1	Greenhouse Gas Emissions	10
	OP 2	Outdoor Air Quality	1
Buildings	OP 3	Building Operations and Maintenance	4
	OP 4	Building Design and Construction	3
	OP 5	Indoor Air Quality	1
Dining Services	OP 6	Food and Beverage Purchasing	4
	OP 7	Low Impact Dining	3
Energy	OP 8	Building Energy Consumption	6
	OP 9	Clean and Renewable Energy	4
Grounds	OP 10	Landscape Management	2
	OP 11	Biodiversity	1-2
Purchasing	OP 12	Electronics Purchasing	1
	OP 13	Cleaning Products Purchasing	1
	OP 14	Office Paper Purchasing	1
	OP 15	Inclusive and Local Purchasing	1
	OP 16	Life Cycle Cost Analysis	1
	OP 17	Guidelines for Business Partners	1
Transportation	OP 18	Campus Fleet	1
	OP 19	Student Commute Modal Split	2
	OP 20	Employee Commute Modal Split	2
	OP 21	Support for Sustainable Transportation	2
Waste	OP 22	Waste Minimization	5
	OP 23	Waste Diversion	3

STARS 2.0 Credit Checklist			
Subcategory	**Credit Number and Title**		**Points**
	OP 24	Construction and Demolition Waste Diversion	1
	OP 25	Hazardous Waste Management	1
Water	OP 26	Water Use	2-6
	OP 27	Rainwater Management	2
	OP 28	Wastewater Management	1

Source: Adapted from AASHE (2014).

Each credit reviewed has a list of "fields" that are included in the reporting tool. Some fields are required while others are listed as optional, if the institution wants to provide additional information. Upon completing the assessment, the university reaches an amount of points, which determines its final rating. Table 5 indicates the rating an institution obtains according to the amount of points it reaches.

Table 5 – STARS Ratings System.

Ratings	Minimum Score
Bronze	25
Silver	45
Gold	65
Platinum	85

Source: Adapted from AASHE (2015).

According to the rating obtained, the institution receives a seal as a form of recognition of the effort made to promote sustainability on campus. Currently more than 700 HEIs from 24 different countries registered at STARS database (Pacheco, 2016).

There are some credits that few institutions will be able to attain at the present moment. Given the diversity of HEIs, some STARS credits may not apply in all cases, and therefore the system allows flexible responses. In some cases, it is also possible to signal that the credit does not apply and, therefore, the institution is not penalized.

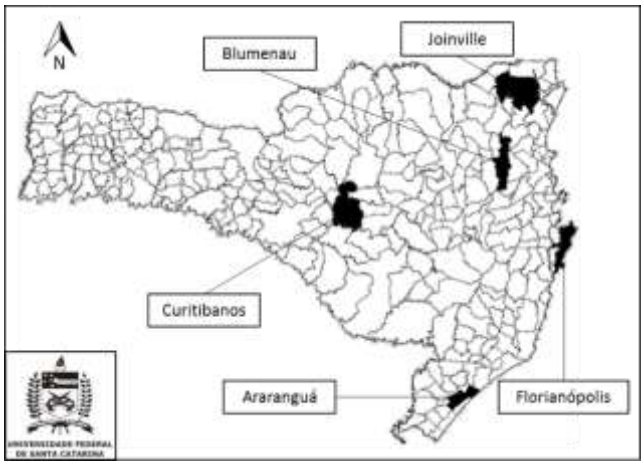
To use the tool, you must register the institution on the STARS website. There are two levels of access: The integral, through the payment of the AASHE annuity; and the basic one, which is free, but does not allow access to some data and statistics, as well as giving only the "Reporter" seal to the institutions.

2.6 Place of Study

The Federal University of Santa Catarina was created by Law nº. 3,849, of December 18, 1960, under the Kubitschek government (UFSC, 2010). In 2007, the Institution joined the Program to Support Plans of Restructuration and Expansion of Brazilian Federal Universities (REUNI, Portuguese acronym) and increased its offer of new courses and expanded the number of places in the existing courses.

In addition, as of 2009, the Institution developed an important strategy for public higher education in Santa Catarina: the expansion of UFSC with the construction of new campuses in the cities of Araranguá (South), Curitibanos (West) and Joinville (North) and, in 2013, it began the process of creating a new Campus Blumenau (UFSC, 2015a). Figure 2 shows the location of the municipalities in which the UFSC's campuses are located.

Figure 2 – Cities where UFSC's campuses are located.



Source: Pacheco (2016).

UFSC has a total area of more than 1600 hectares, more than 42 thousand students, between undergraduation and graduation, and more than 5 thousand servers, between professors and administrative technicians (UFSC, 2015b).

Regarding its environmental aspects, UFSC, in its 2015-2019 Institutional Development Plan (PDI, Portuguese acronym), states that it is committed to the continuous improvement of education, research, culture, art, extension and management practices and that it seeks to implement actions focused on the environment, safety, occupational health and ethical and social responsibility (UFSC, 2015a).

In this sense, UFSC joined the "Sustainable Esplanade" program in 2012, completed the elaboration of its "PLS" in 2013 and concluded its adhesion to the "A3P" program in 2014. Therefore, in 2015, the Institution created the "Sustainability Committee of the University of Santa Catarina", which acts as the "Sustainable Logistics Plan Committee", foreseen in Normative Instruction nº. 10/2012, and as the A3P Committee. Also, in 2015, the Environmental Management Coordination was reinstituted, and is responsible for coordinating UFSC's Sustainability Committee (UFSC, 2014).

In addition, in its 2015-2019 PDI, in "Objective 20" the Institution commits itself to "improve organizational management", having as one of its goals to institutionalize the environmental management actions in the University (UFSC, 2015a).

Methodological procedures

3.1 Characterization of the Research

The present study will be characterized as to its purpose, objectives and methods employed. According to its purpose, this work can be understood as an "applied research", since it aims at the acquisition of knowledge for the purpose of using it in solving real problems (Marconi & Lakatos, 2007; Gil, 2010). This study intends to acquire knowledge about the sustainability of UFSC's operations, in order to understand the reasons that led to the observed situation.

Regarding the objectives, this research is exploratory and explanatory (Gil, 2010). It is exploratory because it aims to increase knowledge about the state of sustainability of UFSC's operations, with the purpose of explaining its current situation and finding the reasons that led to this diagnosis. This research is also explanatory, since it aims to unveil the aspects that influence the sustainability of UFSC's operation, in order to increase the knowledge of its reality.

Regarding the methods used in this study, a bibliographic and documentary research was conducted (Marconi & Lakatos, 2007; Gil, 2010), in addition to the use of STARS v. 2.0 (AASHE, 2014) for the collection and analysis of data on the sustainability of UFSC's campuses operations. For accomplishing this, a comprehensive bibliographical review was made on the relevance of sustainability in higher education and on the assessment tools

available. A documentary review was also conducted on the main governmental programs that promote sustainability, as well as federal regulations on the subject. Finally, the methodological procedures of STARS were followed to perform the data collection and assessment of the sustainability of the University's operations.

3.2 STARS Tool

The procedures adopted in the execution of this study, mainly the steps of data collection and processing, were based on the guidelines of the "STARS Technical Manual. Version 2.0", updated in January 2014 (AASHE, 2014). The Handbook has 350 pages and describes in detail how to perform each part of the data collection process, and how the score of each credit is calculated.

As previously mentioned, STARS is divided into four categories of analysis, one of innovation and it has a section that does not score, but that must be filled which is the "Institutional Characteristics". As the objective of this study was to assess the situation of UFSC campuses' operations, only the fields of the tool that concern "Institutional Characteristics" and "Operations" were filled.

Once the institution was registered in the website, it was possible to work with the tool. STARS is an electronic form accessed via the website. In it, institutions fill in their information while the system calculates the score received for each credit. Also available is a spreadsheet that contains all the questions of the "credits", to help the process of data collection of HEIs' information. The spreadsheet has 525 questions in the "Operations" category, and 74 in "Institutional Features". These questions were translated (to Portuguese) and grouped according to UFSC's administrative sector that deals with the subject to facilitate data collection. Both the translation and the grouping of the questions can be viewed in Pacheco (2016).

The information needed to complete the "Institutional Characteristics" fields was obtained from official documents and specific administrative sectors. The year 2011 was used as the "base year" (reference) and year 2014 as the "performance year", following to the guidelines of STARS' manual.

As for the "Operations", after an initial contact explaining what the purpose of the study was, each set of questions was sent to UFSC's sector that was responsible for the activity in

question. In addition, the sectors were instructed to answer the maximum questions possible. However, whenever it was not feasible to give the requested answer, it was asked of them to explain why, to help in understanding how the operations of the University work.

Results and discussion

Table 6 summarizes the main results obtained when applying STARS to UFSC's operations. The "Observations" column has comments made by the responding operational sectors.

Table 6 – Results obtained by applying STARS to UFSC's operations.

P.P. -Possible Points. U.P. – UFSC's Points. I.D. – Insufficient Data. O.D. – Outdated Data.

Credit			P.P.	U.P.	Observations
Air & Climate	OP-1	Greenhouse Gas Emissions	10,00	0,00	The Institution has no such initiative.
	OP-2	Outdoor Air Quality	1,00	0,00	The Institution has no such initiative.
Buildings	OP-3	Building Operations and Maintenance	4,00	0,02	Only the University Restaurant building meets this criterion.
	OP-4	Building Design and Construction	3,00	0,00	Only the expansion of the civil engineering building meets this criterion.
	OP-5	Indoor Air Quality	1,00	0,00	The Institution has no such initiative.
Dining Services	OP-6	Food and Beverage Purchasing	4,00	I.D.	The Institution acquires a percentage of locally produced products; however, the available control systems do not allow it to be quantified.
	OP-7	Low Impact Dining	3,00	0,00	Organic products are 11% of the Institution's purchase and it offers vegetarian options. However, this percentage and this initiative are not enough to score on this credit.
Energy	OP-8	Building Energy Consumption	6,00	0,00	The energy consumption per square meter of the Institution increased from 2011 to 2014, and UFSC's consumption, according to its area and environmental temperature, is above of what is considered ideal.

Credit			P.P.	U.P.	Observations
	OP-9	Clean and Renewable Energy	4,00	0,00	The university has no control over the generation of electricity that some research projects generate within the Institution.
Grounds	OP-10	Landscape Management	2,00	0,00	There is no integrated pest management plan or a sustainable landscape management program, so the Institution does not have any certification in this regard.
	OP-11	Biodiversity	2,00	0,00	The Institution has not conducted an assessment on vulnerable, threatened or sensitive species and has no plans or programs to protect them. There are isolated initiatives of professors and students, but they are not helped by the Institution.
Purchasing	OP-12	Electronics Purchasing	1,00	0,25	The Institution follows federal regulations on the topic, with preference given for buying equipment registered in EPEAT. The other information needed to compose this credit is not available in the procurement system and could not be accounted for.
	OP-13	Cleaning Products Purchasing	1,00	0,00	There are not many suppliers for these types of products. Currently only request is for these products to be registered in the Ministry of Health.
	OP-14	Office Paper Purchasing	1,00	0,25	Yes. Currently, UFSC acquires around 30% to 50% of recycled A4 paper, which must have the CERFLOR or FSC certificate. The other information needed to compose this credit is not available, as the Institution does not have the specify percentage of post-consumer recycled material that the paper should contain.
	OP-15	Inclusive and Local Purchasing	1,00	I.D.	There is no policy / regulation that states this information, although actions already exist. However, it is not possible to quantify what was specifically spent on this type of purchase.
	OP-16	Life Cycle Cost Analysis	1,00	0,00	The Institution does not have any internal regulations in this sense, nor does the federal government.
	OP-17	Guidelines for Business Partners	1,00	0,00	There are no policies to this effect, however, in some public bids specific requirements are made. Again, it is not possible to quantify and locate contracts for lack of this functionality in the administrative system
Transportation	OP-18	Campus Fleet	1,00	0,13	The Institution has 12 electric golf carts in a fleet of 92 vehicles.
	OP-19	Student Commute Modal Split	2,00	I.D.	The data that the Institution has are from 2009, and it is beyond the accepted deadline for the tool.
	OP-20	Employee Commute Modal Split	2,00	O.D.	The data that the Institution has are from 2009, and it is beyond the accepted deadline for the tool.
	OP-21	Support for Sustainable Transportation	2,00	0,13	The Institution provides places for the “parking” bicycles in all centers. However, it has no initiatives to promote more sustainable means of transportation for its academic community.

Credit			P.P.	U.P.	Observations
Waste	OP-22	Waste Minimization	5,00	I.D.	It was not possible to calculate the first part of this credit for not having data on the generation of waste in 2011. The second part of the credit could not be calculated for not having data on all the campuses, with only one estimate for the Trindade campus.
	OP-23	Waste Diversion	3,00	I.D.	There is no institutional data on materials that are diverted from landfills.
	OP-24	Construction and Demolition Waste Diversion	1,00	I.D.	The Institution does not make any control in this regard.
	OP-25	Hazardous Waste Management	1,00	0,00	The Institution does not have strategies to dispose of ALL hazardous waste, only for laboratories, and does not yet have an established program for the reuse and recycling of electronics.
Water	OP-26	Water Use	4,00	I.D.	Only information on water consumption in Florianópolis is available, and there is no information on the volume of reused water and saltwater used.
	OP-27	Rainwater Management	2,00	0,00	The Institution does not have policies or programs on low impact development practices to reduce runoff from rainwater. It also does not have policies or programs to mitigate the effects of surface runoff from rainwater.
	OP-28	Wastewater Management	1,00	0,00	The Institution does not have data on natural sewage management systems. Individual systems are generally composed of septic tanks, filters and sink or infiltration ditches, not corresponding to natural wastewater treatment systems.
Total			70,00	0,77	

Source: Adapted from Pacheco (2016).

4.1 Analysis of STARS Results

STARS amply covered UFSC's operations and provided an overview of the situation of each assessed activity. However, according to Gómez, Sáez-Navarrete, Lioi, & Marzuca (2015), South American HEIs do not have the resources and structure to complete the more detailed assessments of organizational sustainability, which does not produce a precise measure of reality. In fact, among the 28 credits assessed by the tool, UFSC did not have data to answer eight of them adequately.

In terms of the results, when compared with the maximum possible score, it is observed that the performance of UFSC was quite weak. Most of the credits in which the Institution has shown minimally positive results are related to external regulations, which require certain actions in favor of institutional sustainability.

Table 7 provides a brief analysis of the results UFSC obtained, organized by thematic area, as well as an explanation about the circumstances that led to this situation.

Table 7 – Analysis of the results by thematic area.

Thematic Area	Analysis of the results
Air & Climate	• Score 0, out of 11 possible points; • There are no institutional initiatives in this thematic area; • There is independent research in this area, developed by UFSC's academic community, but it does not have any formal institutional support and they does not meet STARS criteria.
Buildings	• Score of 0,02, out of 8 possible points; • There are federal regulations, such as MPOG IN 2/2014, which require that public buildings have the Procel seal; • Only newer buildings comply with these regulations; • The areas of these buildings are still small when compared to the total built area; • There is an improvement trend in this sense, as the new projects are required to be certified; • As for indoor air quality, the university does not yet have an "internal air quality management program" or any initiative in this regard.
Dining Services	• Score 0, of 7 possible points; • This is due in part to the fact that it is not possible to quantify the amount of purchased food products that are produced under sustainable conditions; • Despite this, this practice already exists within the UFSC, according to the provisions of Decree 8473/2015; • In the second part of this credit the score was null, because the university does not offer vegan options or informs about this type of eating; • The university does, however, offer daily vegetarian options.
Energy	• Score 0, out of 10 possible points; • One contributing factor to this situation was that the institution's energy consumption per square meter increased in 2014 when compared to 2011. • This is possibly explained by an increase in research activities, in addition to the greater number of air conditioners installed in this period. • As for the generation of energy from renewable sources, the Institution does not have a policy to stimulate or record what is generated, although some administrative buildings contain solar panels; • There are some research projects that, by their own motivation, installed solar panels at UFSC, but the Institution does not have information about generation and consumption from these sources.
Grounds	• Score 0, of 4 possible points; • The Institution does not have pest management plans or sustainable or organic landscaping plans for its green areas; • Also, there are no institutional initiatives towards its areas of ecological interest.
Purchasing	• Score of 0,5, out of 6 possible points; • This is the thematic area with the best performance; • The Institution already has specific sustainability criteria for some types of acquisition; • Federal regulations, such as IN 1/2010 of MPOG, contain instructions that guide part of UFSC's actions in this area; • More points could have been achieved in this area, but due to limitations in the control systems it was not possible to quantify them to be included in STARS.
Transportation	• Score 0,26, out of 7 possible points; • Second best performing area; • The Institution fleet has 12 electric golf carts; • UFSC also has bicycle "parking lots" close to practically all buildings;

Thematic Area	Analysis of the results
	• However, it was not feasible to analyze the issues that refer to the mobility of students and servers, since the Institution does not have updated data. • The Institution also does not have initiatives that encourage the academic community to seek alternative means of transportation.
Waste	• Score 0, out of 10 possible points; • The main reason for this is the lack of data on the waste generated in the Institution and the history of this generation; • The Institution only has estimates on the generated waste; • Therefore, there is no basis for actions to improve waste management; • As for hazardous waste, the Institution has the means to dispose part of them, but there are still challenges such as the environmentally appropriate disposal of asbestos tiles, pesticides, TV tubes and computer screens, among others.
Water	• Score 0, of 7 possible points; • This is due in part to the lack of information on water consumption on all campuses; • Another aspect that led to this situation is the lack of institutional plans that deal with rainwater management; • Even so, UFSC seeks to reduce waterproofing of soils and makes use of rainwater in the new buildings; • Despite this, the Institution does not have a policy on wastewater, and whenever possible the buildings are connected to the public sewage network and does not have more natural systems for effluent treatment.

Source: Created by the authors.

In addition to this analysis by thematic area, some more general comments on the limitations observed in the data collection process can be made. Specifically, regarding the credits that the Institution did not score, there were different situations. In certain credits, the Institution did not score because, in fact, it did not develop any initiative pertinent to the matter in question (e.g., "Greenhouse Gas Emission"). In other credits, the Institution already had initiatives in the specified context that, however, were discontinued and could not be fully considered in the analysis (e.g., "Intermodality in the Transport of Employees"). Finally, in other cases, it was not possible to score on some credits due to the lack of availability of institutional information (e.g., "Clean and Renewable Energy"). That is, there are three main reasons that led to the observed results: lack of records and history of institutional actions; discontinued initiatives; and lack of specific initiatives.

Another aspect that stood out in this analysis is the importance of federal regulations. This was noted in the areas of "Buildings", "Meal Services" and "Purchases". Although some of these actions could not be quantified by limitations in the control systems, "Buildings" and "Purchases" were two of the three areas that the university scored. In both cases, the actions were backed by federal regulations that make specific demands on public construction and procurement. This is an indication that there is a relationship between UFSC's most effective actions and federal regulations on the topic.

4.2 The Role of the Federal Government in the Promotion of Sustainability in FHEIs

Applying STARS to UFSC's operations showed the importance that the federal government has as a motivator of regulations promoting sustainability practices, which have had a clear influence on institutional activities.

Since UFSC is a federal autarchy, it must comply with the laws and administrative regulations issued by the federal government. In addition, the Institution is also required to respond to bodies such as the Union's General Controller and the Court of Auditors, which oversee the compliance of institutional practices with federal regulations.

The development of this study demonstrated that the areas in which the UFSC has more actions in favor of sustainability are motivated and overseen by the federal government. This is in line with the thoughts of Wilkinson, Hill and Gollan (2001), who point out that governments are decisive in promoting sustainability, in legislating and setting standards for resource conservation and quality of life.

Table 8 shows a comparison between the operational axes of A3P, the main government program for promoting sustainability in the administrative environment, and the areas of STARS operations. It is clear that some important issues of sustainability management on university campuses are not addressed by the main government program for sustainability.

Table 8 – Comparison between A3P's operational axes and STARS' operational areas.

A3P's operational axes	**STARS' operational areas**
Rational use of natural resources and public goods	Energy
	Water
Adequate management of the waste generated	Waste
Sustainable aquisiton of goods and services	Purchasing
Implementation of criteria for sustainable buildings	Buildings
STARS's areas not included in A3P	
Air & Climate	
Dining Services	
Grounds	
Transportation	

Source: Adapted from Pacheco (2016).

The results of this study indicate that federal regulations have guided and influenced some of UFSC's main actions, either directly or in terms of sustainability planning. In other words, the federal government, in addition to providing resources to FHEIs, also has the power to direct their development.

Considering that in Brazil there are 107 FHEIs, among which 63 universities, it would be pertinent for the federal government to pay special attention to the peculiarities of this unique type of public institution. In this sense, it would be convenient to create a tool for the assessment of sustainability aligned with the reality of FHEIs.

Recently, the Ministry of the Environment developed a management tool and data-processing system, ResSoA, to receive the annual A3P monitoring report. However, the data submitted are still not available in a way that allows comparison between institutions. In addition, as previously mentioned, not all areas relevant to sustainability in HEIs are covered by A3P, specifically in terms of operations.

According to Shriberg (2002), higher education institutions need interinstitutional comparison methods, as well as the means to monitor their evolution in favor of sustainability. Thus, through assessment and periodic reporting tools, the government would have subsidies to evaluate its policies, and FHEIs would have the necessary structure to monitor the sustainability of its operations and other activities.

In this context, considering the difficulties that South American countries have to complete the more detailed sustainability assessments (Gómez, Sáez-Navarrete, Lioi, & Marzuca, 2015), it would be fitting to elaborate a specific tool for the reality of the Brazilian FHEIs, which could have similar features to those of STARS, making it possible to compare the various institutions in the country.

Thus, through the use of assessment tools and periodic reporting, the government would have the means to evaluate the outcome of its policies, and FHEIs would have the bases and tools to monitor the sustainability of their operations and other activities, and intervene in order to seek the continuous improvement of their actions.

4.3 Vision for the future

As Urbanski and Leal Filho (2015) state, the Operations category is the most challenging in STARS for HEIs in terms of winning points. The categories "Academics",

"Engagement" and "Planning and Administration" have policy character and a structuring nature and, in a sense, precede the operational aspects of a campus.

In this sense Amaral, Martins and Gouveia (2015) point out that the lack of connection between the implementation and the management and assessment methods can generate unstable and incomplete sustainability practices. In fact, this seems to have happened throughout the history of UFSC.

When reflecting in terms of continuous improvement, it is imperative for institutions to structure and plan their actions, to execute them, to verify the results through appropriate tools, and to act to correct and adjust whatever is needed.

As previously mentioned, UFSC currently has a sector responsible for the environmental management of the campuses and a commission appointed to monitor and review its Sustainable Logistics Management Plan (motivated by federal regulations), although it still lacks a policy on sustainability.

According to Alshuwaikhat and Abubakar (2008), the establishment of a specific organizational structure, either through a department or a commission, and the availability of resources facilitate the implementation of a sustainability actions in HEIs. However, these initiatives are recent within the Institution, and still have few measurable outcomes (at least with STARS).

This structuring process can directly contribute to two of the main limitations showed in this study: By facilitating the planning of continuous and long-term actions; and by better managing institutional information. It should be noted that this effort must cover all the Institution's units and involve all the relevant operational sectors.

Final considerations

The search for more sustainable operations in universities can bring several benefits to institutions, ranging from purely economic aspects to the development of conscientious professionals, who can be agents of change in society.

The present study is unprecedented, being the first to use a specific tool for the measurement of sustainability in UFSC's campuses. Despite the small amount of institutional data available, it was possible to reach a score for UFSC's campuses operations. Moreover,

throughout the process of using the tool, it was possible to observe overall limitations and identify the critical points in UFSC's operations, which provided a diagnosis of its state.

The development of this study also showed that there are three main reasons for UFSC's low performance in terms of operational sustainability: lack of records and history of institutional actions; discontinuation of initiatives; and absence of actions in important areas.

Nevertheless, this study indicated that specific federal government regulations on sustainability have provided subsidies for effective actions at UFSC. This demonstrates the relevance of federal government actions in promoting sustainability.

The importance of adopting a mechanism for assessing the sustainability of actions on campuses was also illustrated in this study. There is a need to have a structure that plans the actions of the Institution and records the pertinent data. The federal government can also play an important role in this context by supporting and guiding the sustainable development of FHEIs.

Finally, this study produced an initial diagnosis of the main factors that affect the operations of the institution's campuses, which possibly also reflects the reality of other FHEIs in the country. Nevertheless, it would be important to continue to investigate the University with other methodological procedures, to verify the results and to better understand the Institution. It would also be appropriate for other HEIs and FHEIs in Brazil to do the same in order to compare results and exchange experiences in favor of more sustainable universities.

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